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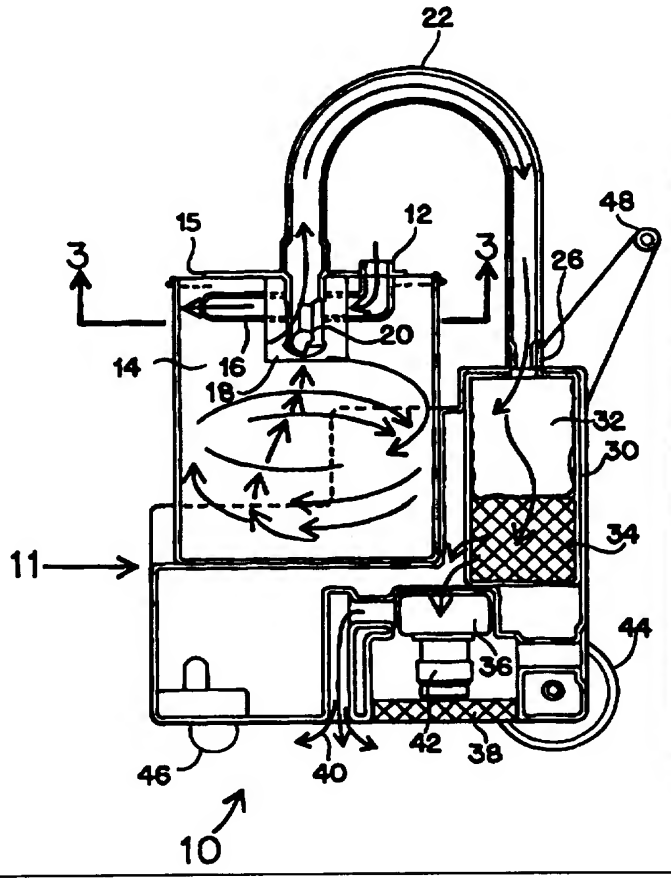
(54) Title: CYCLONIC VACUUM CLEANER

(57) Abstract

A cyclonic vacuum cleaner (10) having a primary reservoir (14) into which air is drawn by a fan (36) through an air intake (12) and into a cyclone tube (16). Intake air exhausts through an open end of the cyclone tube (16) into the primary reservoir (14) where it is drawn against the inside wall of the primary reservoir (14) creating a cyclone. Air is drawn up through the center of the cyclone through a wet and dry filter (18) into a riser intake (20). Air is drawn through the riser (22) and enters a filter housing (30) holding a bag filter (32) and a HEPA filter (34). Air is exhausted from the apparatus through air outlet (40) following passage through the HEPA filter (34).



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TITLE OF INVENTION: CYCLONIC VACUUM CLEANER

DESCRIPTION

BACKGROUND OF THE INVENTION

Technical Field. This invention relates generally to a vacuum cleaner, and more particularly to a portable vacuum cleaner which is constructed to generate a cyclone inside the tank of the vacuum cleaner.

Background: The prior art contains a variety of devices which have employed a cyclonic separator in a vacuum cleaner.

Soler et al., U.S. Patent No. 5,267,371, discloses a cyclonic back pack vacuum cleaner. This patent includes upper and lower casings, and at least one cyclone having a lower part and an air exit port being mounted with the lower part positioned within said lower casing. It also includes a structural limitation that the fan is positioned within the upper casing.

Finke, U.S. Patent No. 5,254,147, teaches a draw-down cyclonic vacuum cleaner wherein air is introduced through an opening in the sidewall of the canister, and impinges

upon and spins downwardly around a tapered cone, and then passes through a bottom wall filter into the interior of the tapered cone, which is at sub-atmospheric pressure and is drawn up through the tapered cone and out of the canister.

Stevenson, U.S. Patent No. 5,248,323, discloses a cyclonic back pack vacuum cleaner providing an activated charcoal layer.

Landy, U.S. Patent No. 5,188,644, teaches a filtered bag wherein air is blown from the central blower spirally out with large particles impacting the sides of the curved passageways. The discharge of the curved passageways are contained within filtering material through which the blown air passes.

Weistra, U.S. Patent No. 5,135,552, discloses a vacuum cleaner having a pair of filters, the first being non-cyclonic, and the second one being cyclonic, with the dust from both filters being deposited in a common reservoir.

Dyson, U.S. Patent No. 5,090,976, claims a liner bag for use with a cyclone separator vacuum cleaner.

Usmani, U.S. Patent No. 4,944,780, discloses a cyclonic -separator type central vacuum cleaner having an in-line configuration.

Farley et al., U.S. Patent No. 3,320,727, teaches bringing dirt laden air into a cyclone separator, and then into a second filtering system positioned above the vacuum cleaner motor.

The above references can be categorized for comparison to the present invention as follows: (a) devices having an air entry means providing an air flow path from outside

the vacuum cleaner into a cyclone typically defined by a physical barrier having a generally conical shape. *See Soler et al., Finke, Stevenson, Dyson and Farley;* (b) devices having an air entry means providing an air flow path from outside the vacuum cleaner to a cyclone defined by a physical barrier having a cylindrical shape contained within a cylindrical container. *See Usmani;* and (c) systems having an air entry means providing an air flow path from outside the vacuum cleaner into cyclonic separator comprised simply of the outside wall of the cylindrical container in which the apparatus is contained. *See Weistra.*

In each of these cases, the means for creating the cyclone, which serves to separate heavier particles from lighter particles, involves the manufacture and assembly of fairly elaborate pieces and parts having relatively complex shapes and tolerances.

Additionally, the filtration systems of the various devices can be categorized as follows: (a) devices having filters following the cyclone in sequence. *See Soler et al., Usmani, Stevenson, Dyson, Farley and Finke;* and (b) systems which employ pre-filtration systems. *See Weistra.*

What is needed is a cyclonic vacuum cleaner which employs means for creating the cyclone which is simple in design and easy to manufacture, yet serves effectively for the intended purpose, namely, removal of large particulate matter from the air flow prior to introduction of the air flow through a filter or series of filters.

Additionally, what is needed is a system which following the separation in the cyclone provides a series

of filters which serve to more completely remove debris and particulate matter from the air flow in an increasingly efficient manner.

DISCLOSURE OF INVENTION

These and other objectives are accomplished by a cyclonic vacuum cleaner having a primary reservoir into which air is drawn by a fan driven by a fan motor. Air enters the primary reservoir through an air intake, where it is drawn into a cyclone tube. There exists a relationship between the diameter of the cyclone tube and the height of the primary reservoir. In order for the invention to function as described, the height of the primary reservoir should be at a minimum three times the diameter of the cyclone tube and optimally, there should exist at least a five to one ratio between the diameter of the cyclone tube and the height of the primary reservoir.

Air introduced into the cyclone tube exhausts through an open end into the primary reservoir. The cyclone tube itself has a generally circular configuration opening to the air intake on one end and exhausting into the primary reservoir on the second end. As the air exhausts from the cyclone tube, it is drawn against the inside wall of the primary reservoir, swirling around and down the inside chamber of the reservoir, creating a cyclone.

Air is drawn up through the center of the cyclone through a wet and dry filter into a riser intake. As the air is drawn through the riser intake into the riser, it leaves the primary reservoir and enters a secondary

reservoir through the secondary reservoir air intake. At the top end of the secondary reservoir there is a filter housing holding a bag filter through which the air is drawn. Following the bag filter is a H.E.P.A. filter.

Following the final filtering in the H.E.P.A. filter, air is drawn through the fan and exhausted through an air outlet.

Sound generated by operation of the vacuum cleaner is depressed by means of a sound defuser at the air outlet and below the fan and motor housing.

The cyclonic vacuum cleaner may be supported and transported by wheels operatively connected to the cyclonic vacuum cleaner or in the alternative may be transported by means of a shoulder strap or a pair of shoulder straps attached to the cyclonic vacuum cleaner for.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 a perspective view of the cyclonic vacuum cleaner;

Fig. 2 is a side view cut-away of the cyclonic vacuum cleaner;

Fig. 3 is a bottom view detail of the cyclone tube;

Fig. 4 is a cut-away detail of the cyclone tube;

BEST MODE FOR CARRYING OUT INVENTION

Referring now to Figs. 1 through 4, the preferred embodiment of cyclonic vacuum cleaner 10 is shown to

advantage. Fig. 1 shows vacuum housing 11 having rear wheels 44, front wheels 46 and handle 48. Vacuum housing 11 also houses the various components described more fully herein.

Referring now to Fig. 2, a side view cut-away of cyclonic vacuum cleaner 10 is more fully shown. Primary reservoir 14 is attached atop vacuum housing 11. Removably attached to primary reservoir 14 is reservoir 15, which is sealed by conventional means to create an air-tight canister. Housed within reservoir 14 are cyclone tube 16, wet/dry filter 18, and riser intake 20. Air is drawn into primary reservoir 14 through air intake 12 by fan 36 which is driven by fan motor 42. Air is drawn through primary reservoir 14 through air intake 12, where it is drawn into cyclone tube 16. Air exhausts through cyclone tube exhaust 24 into primary reservoir 14. Cyclone tube 16 has a generally circular configuration opening to air intake 12 at its first end and exhausting into primary reservoir 14 through cyclone tube exhaust 24. Air exits primary reservoir 14 through riser intake 20 which is in serial relationship to and in fluid connection with primary reservoir 14 passing to filter housing 30 via riser 22.

Air which is drawn from primary reservoir 14 into filter housing 30 enters filter housing 30 through filter housing air intake 26.

Filter housing 30 houses bag filter 32 and H.E.P.A. filter 34 which is in serial relationship to and in fluid connection with bag filter 32. Located below filter housing 30 is fan 36 driven by fan motor 42. Air exhausts

from the unit via air outlet 40.

Referring now to Figs. 1 through 4, in operation, air is drawn by fan 36 which is driven by fan motor 42 through primary reservoir 14 through air intake 12, where it is drawn into cyclone tube 16. Air exhausts through cyclone tube exhaust 24 into primary reservoir 14. As air leaves cyclone tube exhaust 24, it impinges on the inside wall of primary reservoir 14, swirling down and around the inside of primary reservoir 14, creating a cyclone. Air is drawn up through the center of the cyclone through wet/dry filter 18, into riser intake 20. Air crosses from primary reservoir 14 into filter housing 26 via riser 22 which connects at its first end to riser intake 20 and at its second end to filter housing air intake 26.

Inside filter housing 30 are contained bag filter 32 which the air is drawn through for passing to the H.E.P.A. filter. Air passes from the H.E.P.A. filter through fan 36 and is exhausted from cyclonic vacuum cleaner 10 via air outlet 40.

While there is shown and described the present preferred embodiment of the invention, it is to be distinctly understood that this invention is not limited thereto but may be variously embodied to practice within the scope of the following claims.

I claim:

1. A cyclonic vacuum cleaner comprising:

a fan operatively connected to a fan motor;

a primary reservoir into which air is drawn by operation of the fan driven by the fan motor through an air intake;

a cyclone tube having a generally circular configuration in serial relationship to and in fluid connection with the air intake on a first end and exhausting into the primary reservoir through a cyclone tube exhaust;

a riser in serial relationship to and in fluid connection with a riser intake on a first end and in serial relationship to and in fluid connection with a filter means on a second end; and

an air outlet in serial relationship to and in fluid connection with the filter means.

2. A cyclonic vacuum cleaner comprising:

a fan operatively connected to a fan motor;

a primary reservoir into which air is drawn by operation of the fan driven by the fan motor through an air intake;

a cyclone tube having a generally circular configuration in serial relationship to and in fluid connection with the air intake on a first end and exhausting into the primary reservoir through a cyclone tube exhaust;

a riser intake located at the upper end of the primary reservoir in serial relationship to and in fluid connection with the primary reservoir;

a riser in serial relationship to and in fluid connection with the riser intake on a first end and in serial relationship to and in fluid connection with a secondary reservoir through a secondary reservoir air intake;

a bag filter located within the secondary reservoir in serial relationship to and in fluid connection with the secondary reservoir air intake;

a H.E.P.A. filter located within the secondary reservoir in serial relationship to and in fluid connection with the bag filter; and

an air outlet in fluid connection with the fan driven by the fan motor.

3. The cyclonic vacuum cleaner of Claim 2 further comprising wheels for supporting and transporting the cyclonic vacuum cleaner.

4. The cyclonic vacuum cleaner of Claim 2 further comprising a shoulder strap attached to the cyclonic vacuum cleaner for transporting the cyclonic vacuum cleaner.

5. The cyclonic vacuum cleaner of Claim 2 further comprising a sound diffuser for diffusing sound generated by operation of the cyclonic vacuum cleaner.

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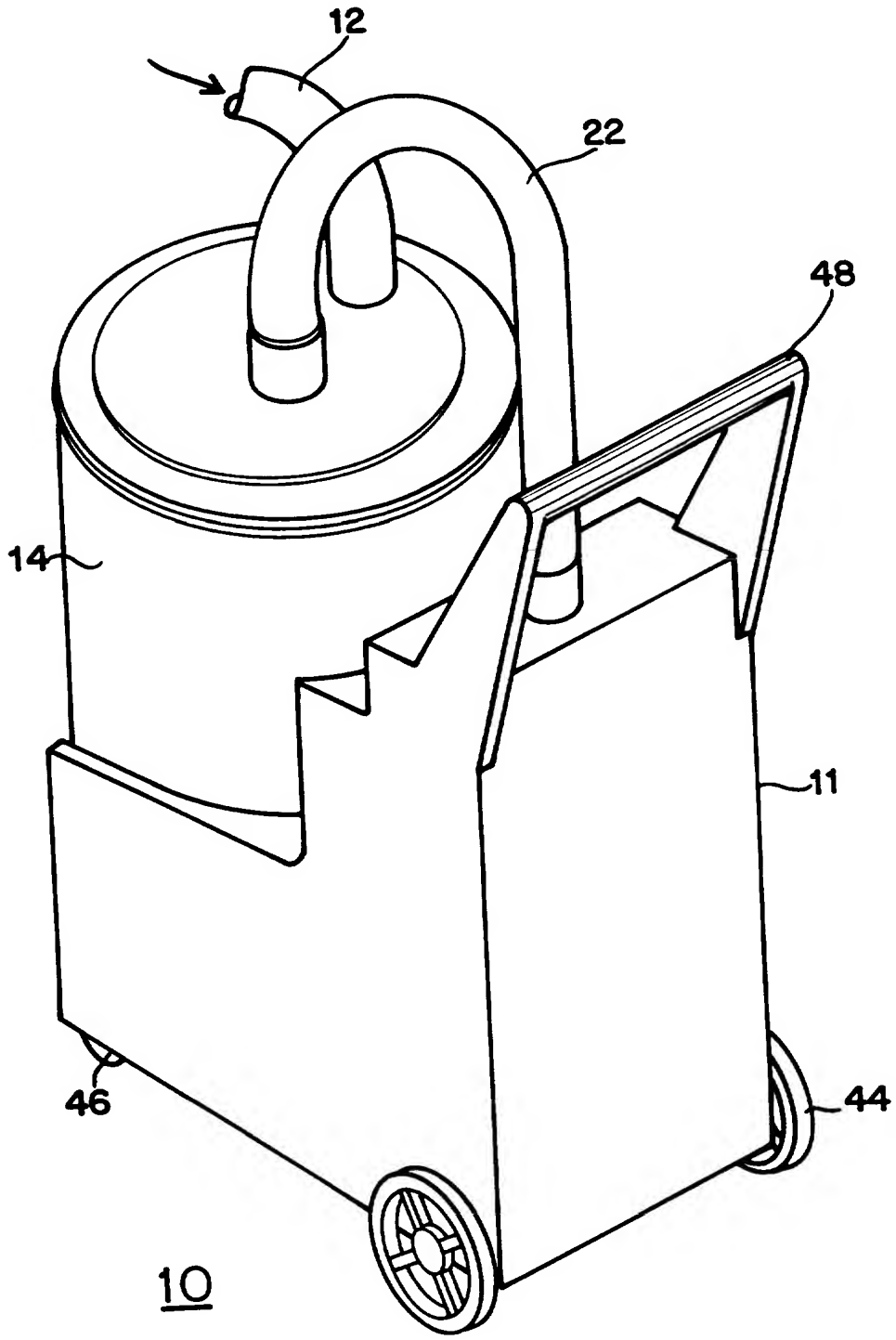

FIG. 1

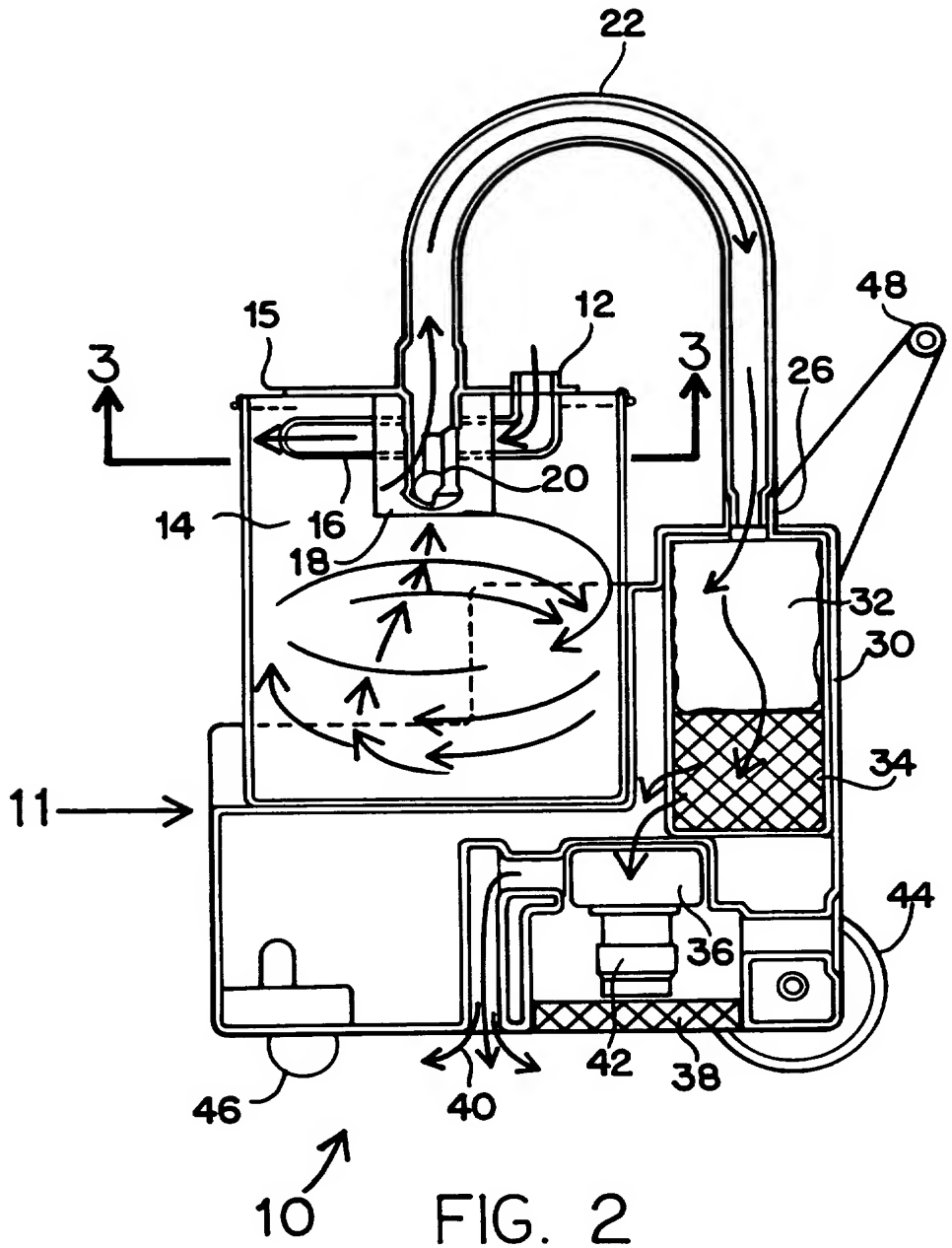

FIG. 2

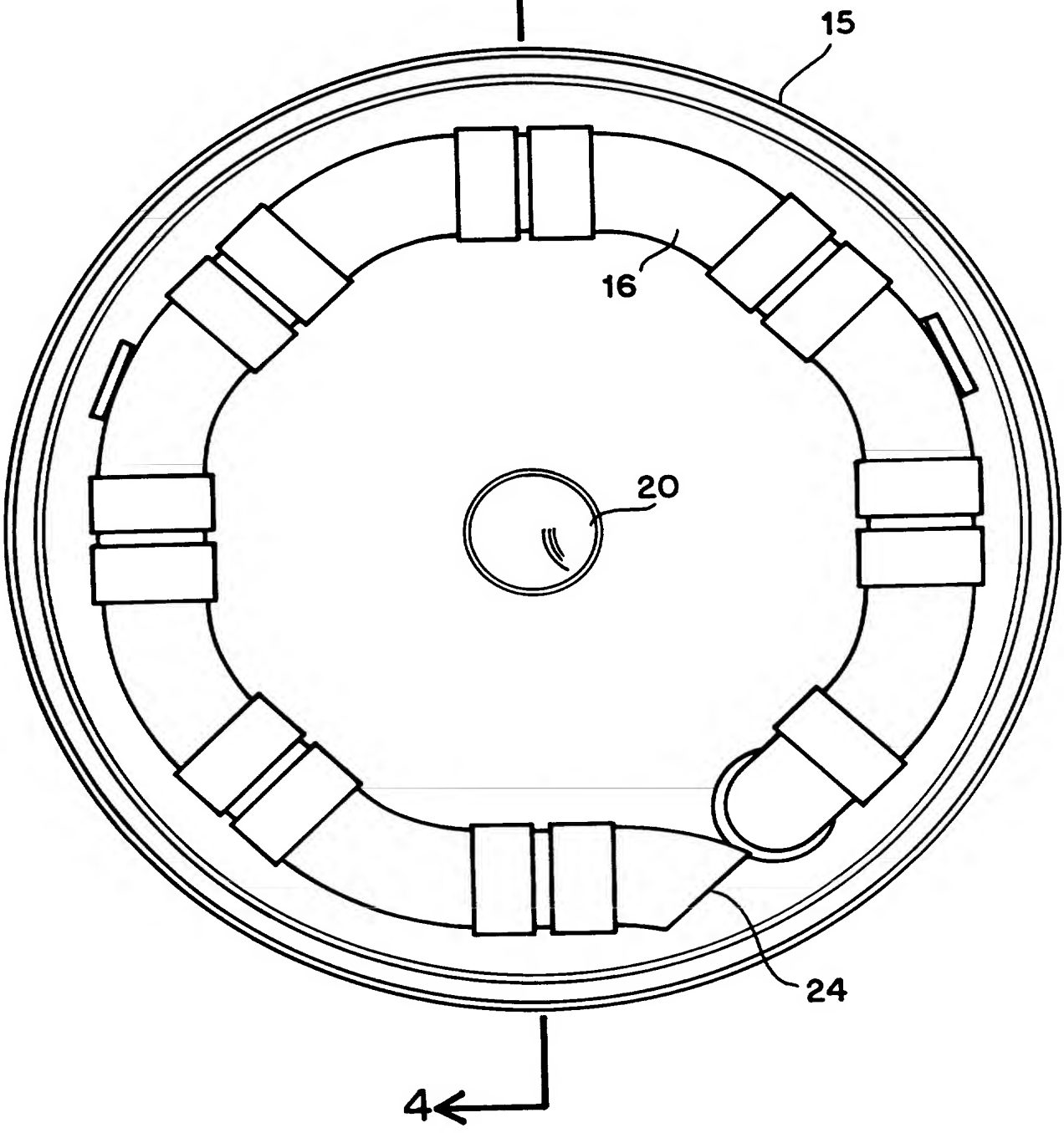

FIG. 3

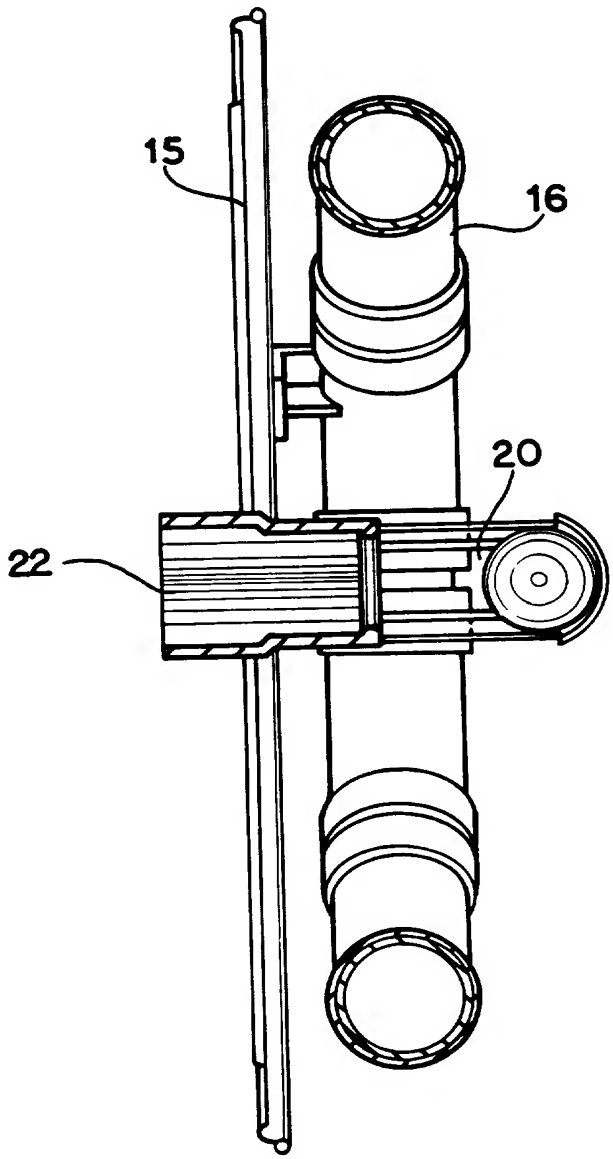

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/07058

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :B01D 50/00
US CL :55/323, 334, 337, 356, 472
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 55/323, 334, 337, 356, 357, 472, DIG. 3; 95/268

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

NONE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 926,070 A (MATCHETTE) 22 June 1909.	
A	US 2,198,568 A (YONKERS, JR.) 23 April 1940.	
A	US 2,684,125 A (BRACE) 20 July 1954.	
A	US 3,320,727 A (FARLEY ET AL) 23 May 1967.	
X ----- Y	US 4,581,050 A (KRANTZ) 08 April 1986, see figs. 3 and 8, col. 3, lines 5-14, 59-68; col. 4, lines 1-29; col. 5, lines 48-58; col. 6, line 60 through col. 7, line 17.	1-3,5 -------- 4
X ----- Y	US 5,230,722 A (YONKERS) 27 July 1993, see figs. 5, 6, and 8; col. 1, lines 39-41; col. 3, lines 4-13, 59-62.	1 ----- 4

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

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INTERNATIONAL SEARCH REPORT

International application No.
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,267,371 A (SOLER ET AL) 07 December 1993, see figs. 1-3.	4